BQUANT Dashboard

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Type Dashboard

Title International Yield Monitor

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Description Collection of statistics, figures, and tables that allow the user
to quickly visualize information about a country's fixed income market.

Suggests bql, bqplot, ipywidgets, pandas, numpy

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1 Methodology

1.1 Yield Curve

Details

> "A yield curve is a line that plots yields (interest rates) of bonds having equal credit quality but differing maturity dates. The slope of the yield curve gives an idea of future interest rate changes and economic activity.
>
> There are three main shapes of yield curve shapes: normal (upward sloping curve), inverted (downward sloping curve), and flat." (Investopedia)

Import this data in BQNT

As in the "BQL for Yield Curves" project inside "BQL for Fixed Income":

```python
import bql
import pandas as pd
from collections import OrderedDict

bq = bql.Service()

#define curve universe
curve = bq.univ.members('YCGT0022 Index',type='curve_tenors')

flds = OrderedDict()

#specify data fields to pull for each bond
flds['tenor'] = bq.data.id()['tenor']
flds['rate'] = bq.data.curve_rate(side='mid')

req = bql.Request(curve, flds)
res = bq.execute(req)

#create dataframe
yc = pd.DataFrame({r.name:r.df()[r.name] for r in res})
yc
```

Listing 1: Import Yield Curve for United Kingdom

As the reader may know, we have imported the yield curve for the United Kingdom. If the reader wants to change the country he can access a table with the ticker for several countries <u>here</u>. The column with the ticker to import the yield curve is "Yield Curve". This file will be useful in many parts of this documentation. From now on, we will reference this Google Sheet file as "External Reference File".

1.2 Yield Curve Slope

Details

> "The slope of the yield curve provides an estimate of expected interest rate fluctuations in the future and the level of economic activity." (WallStreetMojo)

$$10Y - 5Y = SPOT\ RATE_{10} - SPOT\ RATE_5$$

Import this data in BQNT

```
1 # Variable "yc" previously created ("Yield Curve" subsection)
2 ten_year_rate = yc.loc[yc["tenor"] == "10Y"].iloc[0,1]
3 five_year_rate = yc.loc[yc["tenor"] == "5Y"].iloc[0,1]
4
5 spread_10y_5y = ten_year_rate - five_year_rate
6 round(spread_10y_5y, 4)
```
Listing 2: Calculate Yield Curve Slope for United Kingdom

1.3 Forward Rate Agreement

Details

"A forward rate agreement (FRA) is an over-the-counter contract designed to fix the interest rate that will apply to either borrowing or lending a certain principal amount during a specified future time period. When an FRA is first negotiated the specified interest rate usually equals the forward rate. The contract then has zero value." (Hull, J. Option, Futures and other Derivatives)

$$FRA5Y5Y_{NominalRate} = \left(\left[\frac{(1 + SPOT\ RATE_{10})^{10}}{(1 + SPOT\ RATE_5)^5} \right]^{0.5} - 1 \right) * 100$$

Import this data in BQNT

```
1 # Variable "ten_year_rate" and "five year rate" previously created ("Yield Curve
    Slope" subsection)
2 fra5y5y = ((((((1 + ten_year_rate / 100) ** 10) / ((1 + five_year_rate / 100) ** 5))
    ** 0.5)) - 1) * 100
3 round(fra5y5y,4)
```
Listing 3: Import Yield Curve for United Kingdom

1.4 Implied Inflation

Details

"Implied Inflation or Breakeven Inflation rate is the differential between a long-term nominal bond yield and the real yield available on an index-linked bond." (European Central Bank)

Import this data in BQNT

```
1 import bql
2 import pandas as pd
3 from collections import OrderedDict
4
5 bq = bql.Service()
6
7 bql_item = bq.data.px_last(fill='prev')
8
9 bql_universe = "BPSWIT10 Curncy"
```

```
10
11  request = bql.Request(bql_universe, bql_item)
12  response = bq.execute(request)
13
14  implied_inflation = response[0].df()
15  implied_inflation = implied_inflation.iloc[0][2]
```

<div align="center">Listing 4: Import Implied Inflation for UK</div>

The tickers needed to import this data for other countries can be found in the External Reference File in the column "Implied Inflation".

1.5 Credit Default Swap

Details

> "A CDS is like an insurance contract that pays off if a particular company or country defaults. The company or country is known as the reference entity. The buyer of credit protection pays an insurance premium, known as the CDS spread, to the seller of protection for the life of the contract or until the reference entity defaults." (Hull, J. Options, Future and other Derivatives

Import this data in BQNT

```
1   import bql
2
3   bq = bql.Service()
4
5   def cds(tenor):
6
7       cds = bq.univ.cds("6152Z LN Equity", TENOR=tenor+'Y')
8       cds_item = bq.data.cds_spread(fill='prev')
9
10      request = bql.Request(cds,cds_item)
11      response = bq.execute(request)
12
13      cds_data = response[0].df()
14      return cds_data
15
16  cds5y = cds('5').iloc[0,1]
17  cds10y = cds('10').iloc[0,1]
```

<div align="center">Listing 5: Import CDS 5y and 10y for the UK</div>

The tickers needed to import this data for other countries can be found in the External Reference File in the column "CDS".

1.6 Inflation

Details

> "Inflation is a sustained rise in the general level of prices—the price level. The inflation rate is the rate at which the price level increases.(Blanchard, O. Macroeconomics)"

Import this data in BQNT

```
1  import bql
2  import pandas as pd
3
4  bq = bql.Service()
5
6  univ = "BR"
7
8  # Last Twelve Months Inflation
9  inflation = bq.data.cpi(transform = 'pct',
10             period_over_period = 'yoy',
11             period_offset = "0a")
12 # Expected Inflation for the current year
13 expected_inflation = bq.data.cpi(period_offset = "1a", pt = "a")
14
15 request = bql.Request(univ, {"LTM Inflation":inflation, "Expected Inflation":
       expected_inflation})
16 response = bq.execute(request)
17
18 inflation = pd.DataFrame({r.name:r.df()[r.name] for r in response})
19 inflation
```

Listing 6: Import Inflation for Brazil

The tickers needed to import this data for other countries can be found in the External Reference File in the column "Initials".

1.7 Natural Real Interest Rate

Details

"The natural rate is defined to be the real fed funds rate consistent with real GDP equaling its potential level (potential GDP) in the absence of transitory shocks to demand. Potential GDP, in turn, is defined to be the level of output consistent with stable price inflation, absent transitory shocks to supply. Thus, the natural rate of interest is the real fed funds rate consistent with stable inflation absent shocks to demand and supply." (Federal Reserve Bank of San Francisco)

$$\text{NRIR} = FRA5Y5Y_{NR} - FRA5Y5Y_{CDS} - IF_{10y}$$

where NRIR is the Nominal Rate Interest, $FRA5Y5Y_{NR}$ is the Forward Rate Agreement of Spot Nominal Rate, IF_{10y} is the Implied Inflation 10Y, and $FRA5Y5Y_{CDS}$ is the Forward Rate Agreement of Credit Default Swap. The last term is calculated as follows:

$$FRA5Y5Y_{CDS} = \left(\left[\frac{(1 + CDS_{10})^{10}}{(1 + CDS_5)^5} \right]^{0.5} - 1 \right) * 100$$

Import this data in BQNT

```
1  # Variable "cds10y" and "cds5y" previously created ("Credit Default Swap" subsection)
2  fra5y5y_cds = (((((1 + cds10y/10000) ** 10)/((1 + cds5y/10000) ** 5)) ** 0.5) - 1) *
        100
3
4  # Variable "fra5y5y" previously created ("Forward Rate Agreement" subsection)
5  # Variable "implied_inflation" previously created ("Implied Inflation" subsection)
6  nrir = fra5y5y - fra5y5y_cds - implied_inflation
```
Listing 7: NRIR for UK

1.8 Rating

Details

"A firm's credit rating is a measure of the firm's propensity to default. Credit ratings are typically identified with elements of a finite set, also referred to as the set of credit classes or credit grades. In some cases, the credit classes may correspond to credit ratings attributed by a commercial rating agency, such as Moody's Investors Service, Standard Poor's Corporation, or Fitch IECA, Duff & Phelps (Bielecki, T.; Rutkowski, M. Credit Risk: Modeling, Valuation and Hedging)"

```
1  import bql
2  import pandas as pd
3
4  bq = bql.Service()
5
6  rating_moody = bq.data.credit_rating('moody')
7  rating_fitch = bq.data.credit_rating('fitch')
8  rating_sp = bq.data.credit_rating('sandp')
9
10 bql_request = bql.Request("111136Z BB Equity", {"Moody": rating_moody,
11                                                 "Fitch": rating_fitch,
12                                                 "Standard & Poor": rating_sp})
13 bql_response = bq.execute(bql_request)
14
15 ratings = pd.DataFrame({r.name:r.df()[r.name] for r in bql_response})
16 ratings
```
Listing 8: Credit Rating for Belgium

The tickers needed to import this data for other countries can be found in the External Reference File in the column "CDS".

1.9 Target Rate

Details

A target rate is a key interest rate that a central bank uses to guide monetary policy toward the desired economic outcomes. (Investopedia)

Import this data in BQNT

```
import bql
import pandas as pd
from collections import OrderedDict

bq = bql.Service()

bql_item = bq.data.px_last(fill='prev')
bql_universe = 'FDTRMID Index'

bql_request = bql.Request(bql_universe, bql_item)
bql_response = bq.execute(bql_request)

target_rate = bql_response[0].df()
target_rate.iloc[0][2]
```

Listing 9: Import policy rate for USA

The tickers needed to import this data for other countries can be found in the External Reference File in the column "Policy Rate".

1.10 Yield to Maturity

Details

"The yield to maturity is the interest rate that will make the present value of a bond's cash flows equal to its market price plus accrued interest." (Fabozzi, F. Fixed Income Analysis)

Import this data in BQNT

```
bql_item = bq.data.yield_()

# Variable "yc" previously created ("Yield Curve" subsection")
bql_universe = yc.reset_index()["ID"][1]

bql_request = bql.Request(bql_universe, bql_item)
bql_response = bq.execute(bql_request)

bql_response[0].df()
```

Listing 10: Import yield for UK bond

1.11 Duration

Details

"Duration is a measure of the price sensitivity of a bond to a change in yield. So, for example, if the duration of a bond is 10.44, this means that the approximate percentage price change if yields change by 100 basis points is 10.44%." (Fabozzi, F. Fixed Income Analysis)

Import this data in BQNT

```
1  bql_item = bq.data.duration()
2
3  # Variable "yc" previously created ("Yield Curve" subsection)
4  bql_universe = yc.reset_index()["ID"][1]
5
6  bql_request = bql.Request(bql_universe, bql_item)
7  bql_response = bq.execute(bql_request)
8
9  bql_response[0].df()
```

Listing 11: Import yield for UK bond

2 How to use the international yield monitor

2.1 Step 1

Choose the country that you would like to see the data about the local bond market (Figure 1). Figure 3 shows an example of the yield curve and the indicators about the selected country.
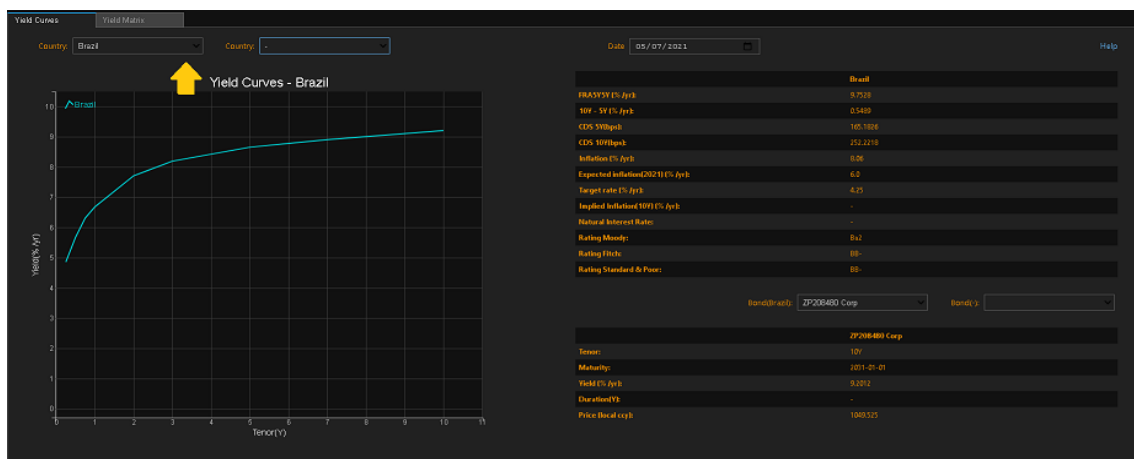
Figure 1: Select the first dropdown.
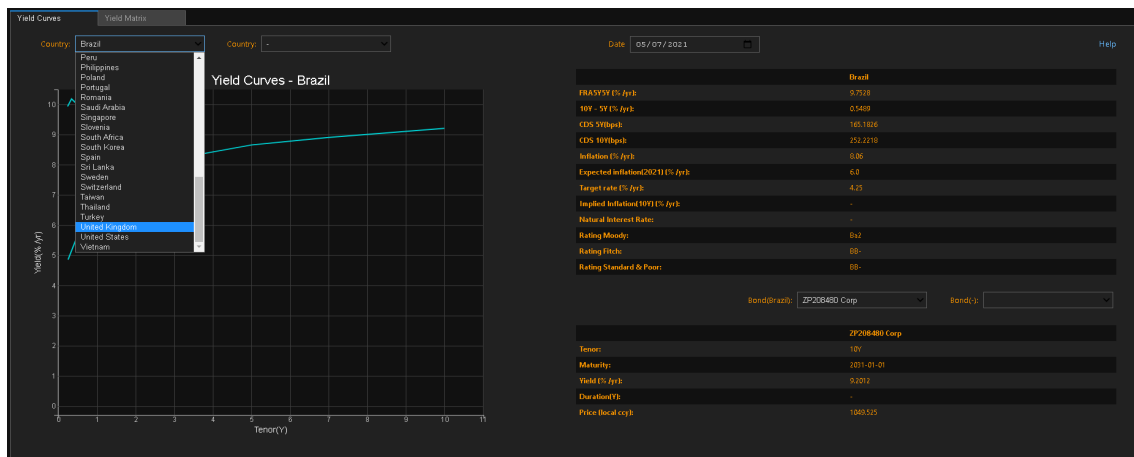
Figure 2: Choose a country in the list.
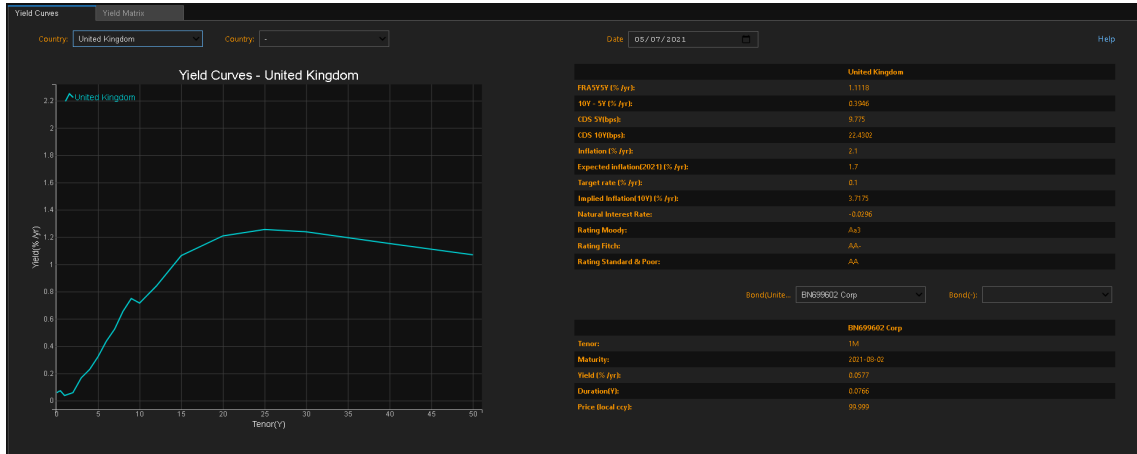
Figure 3: The yield curve and bond market indicators

2.2   Step 2

Now, select a bond of the chosen country, as in figure 4. You will have the Tenor, Maturity, Yield to Maturity (YTM), and Price for the country's bond. The list doesn't show inflation linked bonds. After choosing the bond, you can change the date of the information by selecting the dropdown called "Date", as Figure 5. Figure 6 shows you the comparison between the current yield curve and the yield curve on the chosen date. You can also select a second bond, as figure 7.
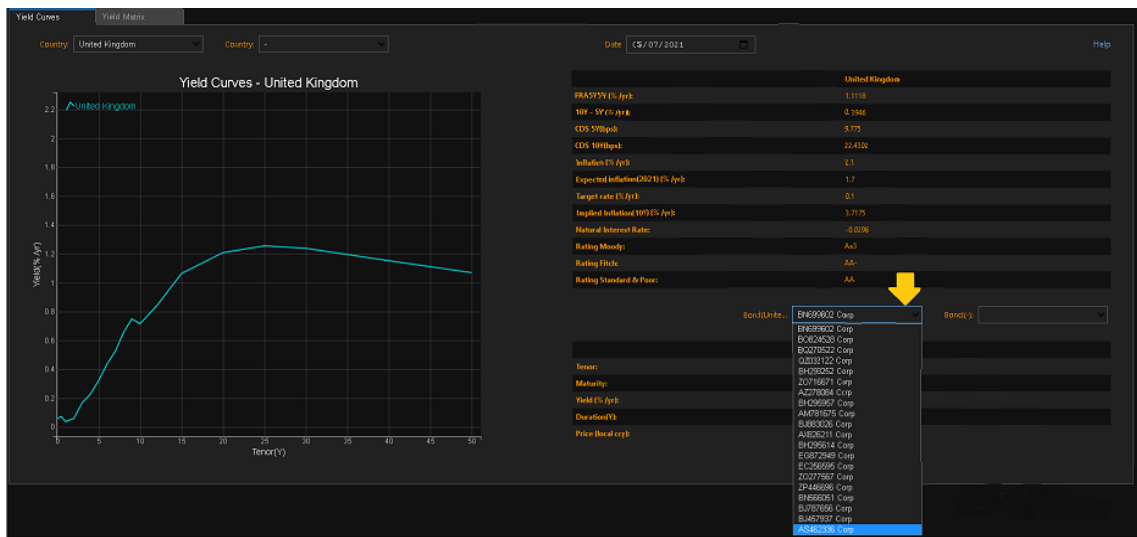
Figure 4: Select a bond in the list.
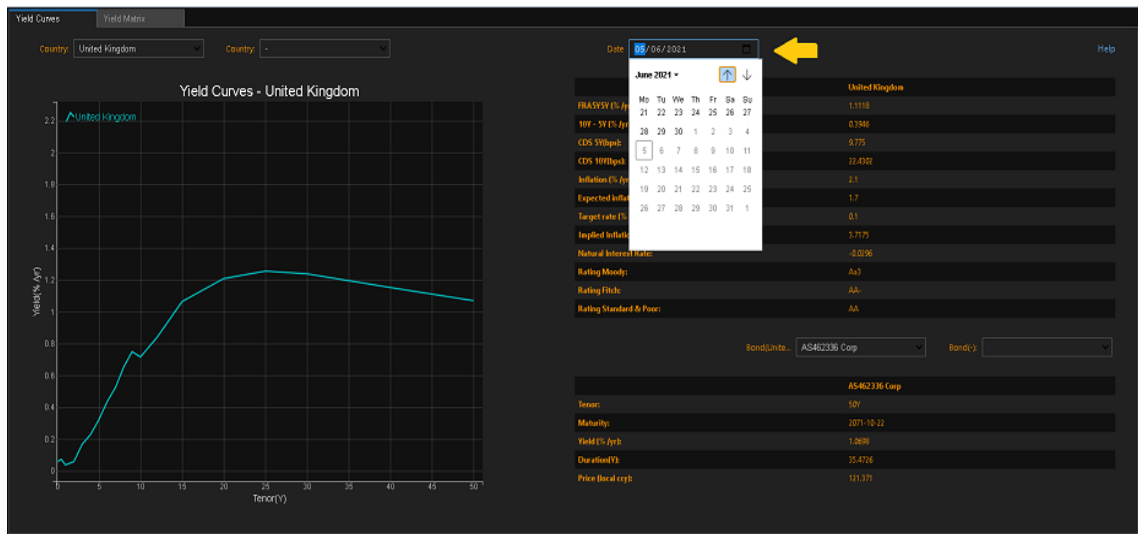
Figure 5: Select the date of your information.
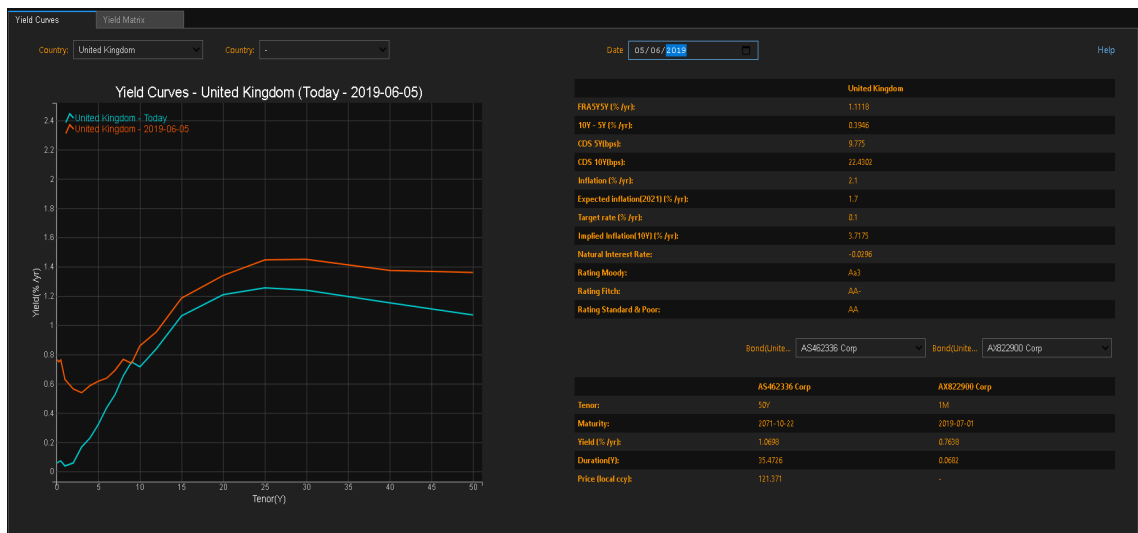
Figure 6: The comparison between the current yield curve and the yield curve on the chosen date.
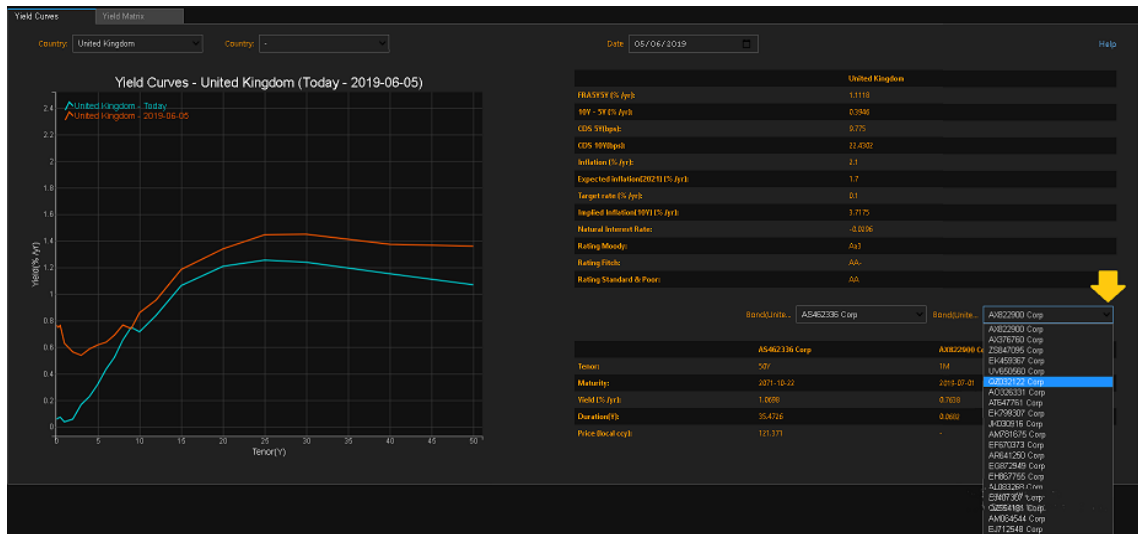
Figure 7: Select the second bond.

2.3 Step 3

If you want to compare the bond market of different countries, the international yield monitor also allows you to make this comparison. Just select the second dropdown called "country" and choose the country you want to compare, as in Figure 8. Figure 9 shows an example of a comparison between the United Kingdom's bond market and the French bond market.
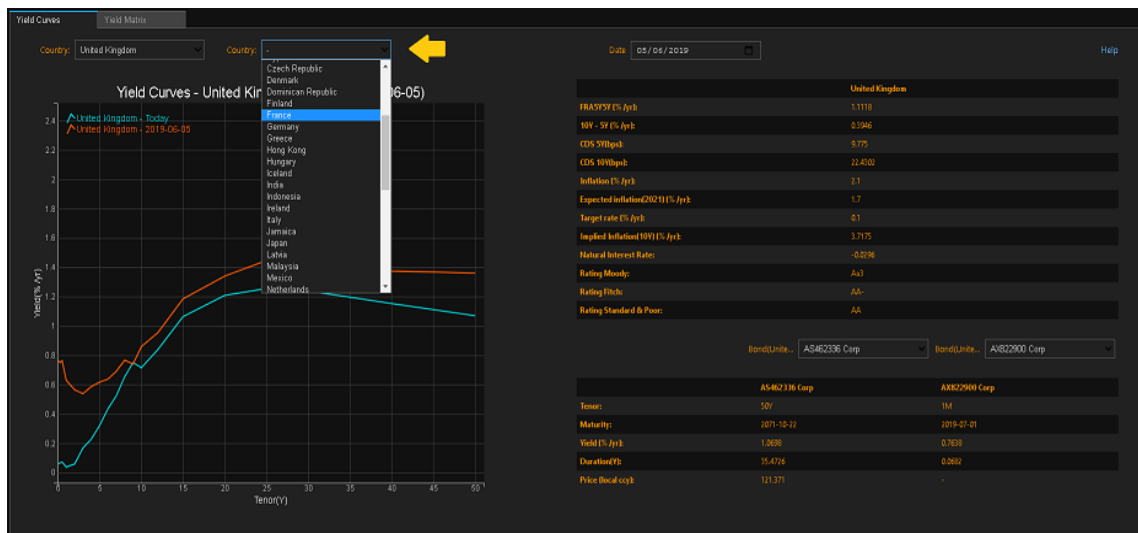
Figure 8: Select the second country.
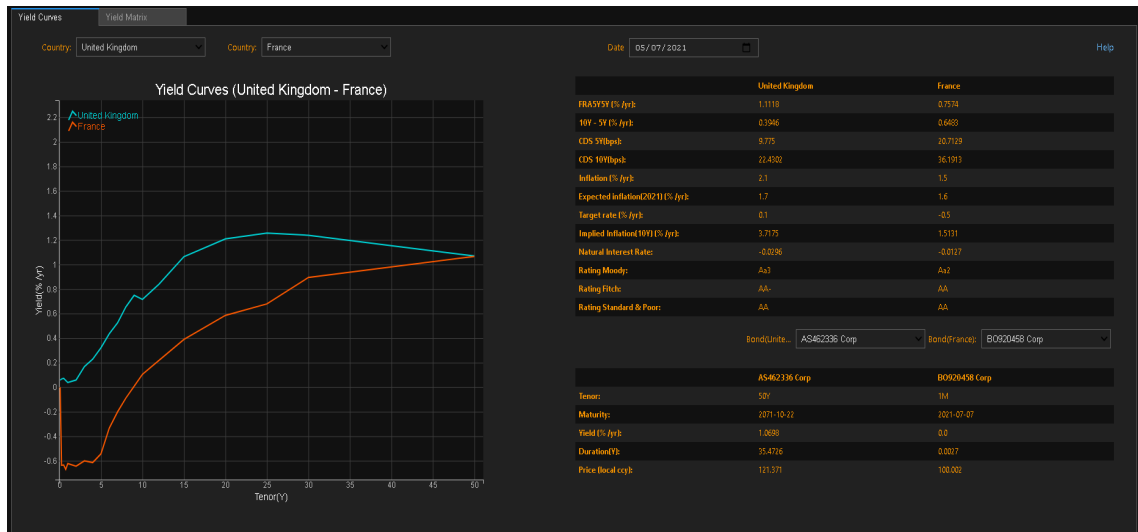
Figure 9: The comparison of the United Kingdom's bond market and French bond market.

2.4 Step 4

If you want to compare more than two countries, you can select the second tab called "Yield Matrix". This tab lists different countries and the maturity of their bonds. In this way, you can see today's yield to maturity and the change in base points of this yield on an earlier date. The matrix allows you to choose two countries, in addition to the G7 countries. For this, select the dropdown called "Country" and choose the desired countries, as in Figure 10. For the date of change in yield, select the dropdown called "Change since", as shown in Figure 11.


Figure 10: Select the countries in the yield matrix.
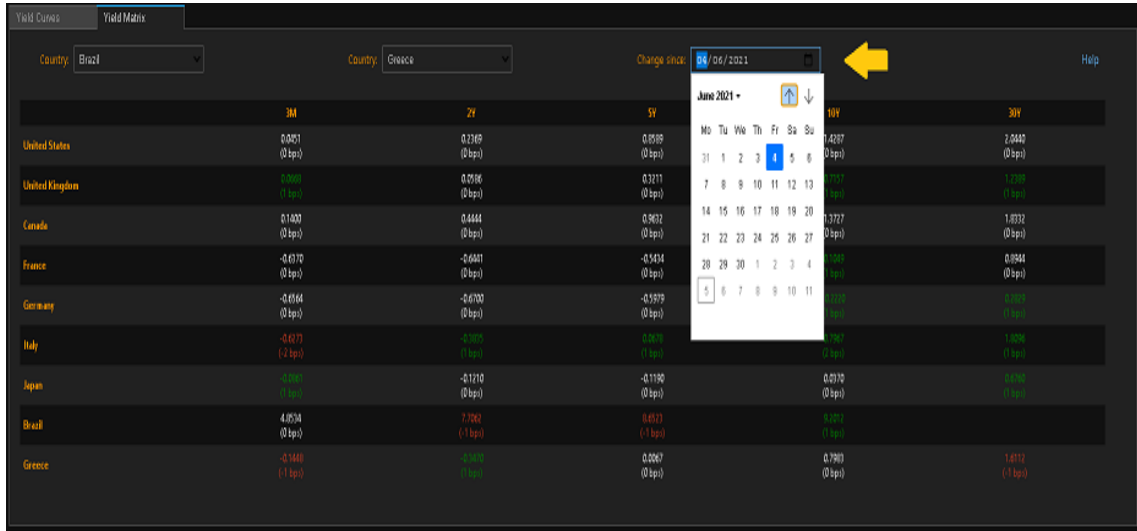
Figure 11: Select the date.
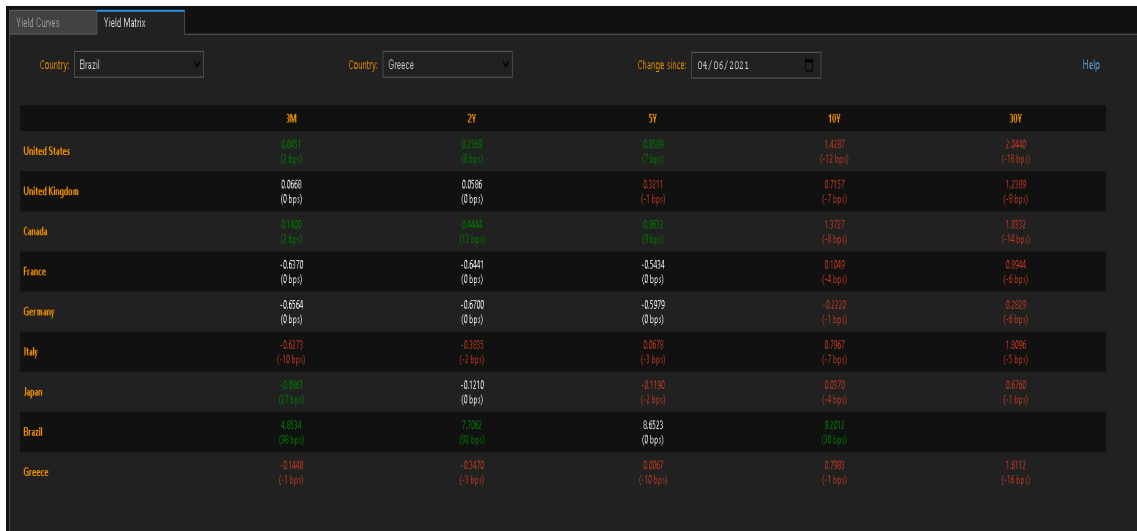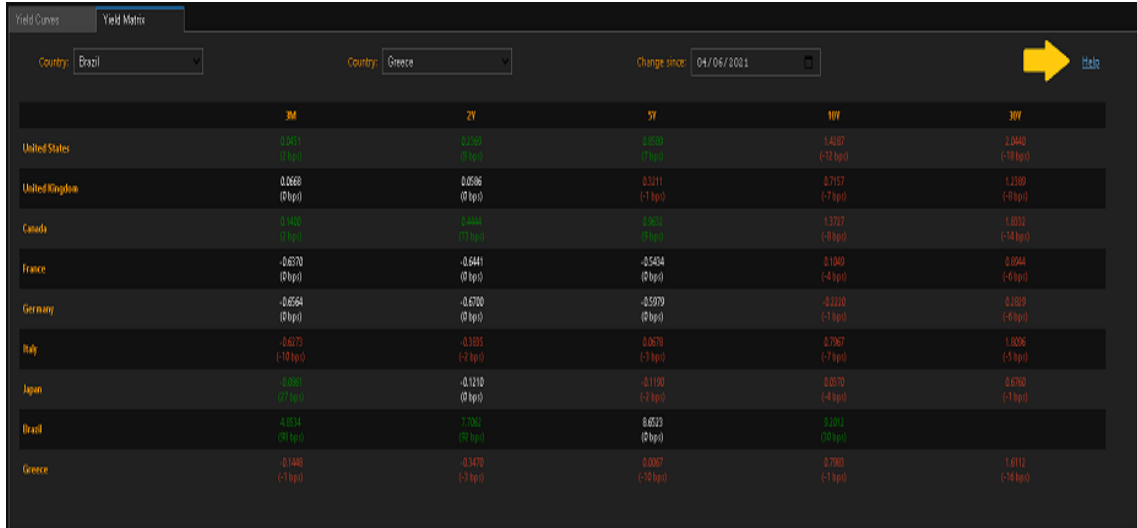
Figure 12: Yield matrix with G7's countries plus Brazil and Greece.

2.5   Step 5

If you want to access this document again, click on "help", as in Figure 13.

Figure 13: Help.